

EX PARTE OR LATE FILED

RECEIVED

HOGAN & HARTSON

ORIGINAL NOV 14 2001

L.L.P.

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

COLUMBIA SQUARE

555 THIRTEENTH STREET, NW

WASHINGTON, DC 20004-1109

TEL (202) 637-5600

FAX (202) 637-5910

WWW.HHLAW.COM

ARI Q. FITZGERALD
PARTNER
(202) 637-5423
AQFITZGERALD@HHLAW.COM

November 14, 2001

By Hand

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C. 20554

**Re: Revision of Part 15 of the Commission's Rules Regarding
Ultra-Wideband Transmission Systems
ET Docket No. 98-153
*Ex Parte Communication***

Dear Ms. Salas:

I am writing on behalf of the Short Range Automotive Radar Frequency Allocation group ("SARA"), an association of automotive and automobile component manufacturers, to notify you of an *ex parte* meeting with staff from the Office of Engineering and Technology ("OET") that occurred on Tuesday, November 13, 2001, concerning issues related to the above-referenced proceeding. A copy of the handout distributed at the meeting is attached hereto.

The meeting was held to address the use of 24 GHz ultra-wideband ("UWB") radar systems designed to enhance road safety. In the meeting, participants explained the operational parameters of the different radar devices proposed by SARA members. SARA's core proposals for inclusion in the Commission's forthcoming UWB Report and Order are set out on pages 12-14 of the attached presentation. In addition to these proposals, SARA particularly seeks clarification on the issues discussed below.

First, SARA does not believe the Commission intends to preclude from operation multimode 24 GHz radar systems that operate in different modes that comply with different sections of Part 15. In this instance, the 24 GHz automotive radars described in this presentation would qualify under rules promulgated in the Commission's UWB Report & Order, under 47 C.F.R. § 15.245, and/or under 47 C.F.R. § 15.249. In an effort to ensure that there is no misunderstanding on this

ARI Q. Fitzgerald *at*
11/14/01

point, we believe it is important for the Commission to clarify in its UWB Report & Order both of the following:

- Clarification 1: A 24 GHz radar device that operates for a pre-set time in one mode and a pre-set time in another mode may be authorized under the separate Part 15 rule parts that apply to the different modes.
- Clarification 2: A 24 GHz radar device that operates for an adaptively variable time in one mode and an adaptively variable time in another mode may be authorized under the separate Part 15 rule parts that apply to the different modes.

Second, SARA does not believe the Commission intends to limit the deployment of carrier-based pulsed UWB systems, but SARA believes clarification is necessary regarding the treatment of residual carrier emissions in light of paragraph 43 of the Commission's Notice of Proposed Rulemaking, ET Docket No. 98-153, FCC 00-163 (rel. May 11, 2000) ("NPRM"). Any of the following options would achieve the requested clarification:

- Option 1: Any 24 GHz waveform that is the sum of wideband and narrowband components is acceptable, regardless of how it is produced, provided that its spectral emission properties can be shown to be equivalent to the sum of multiple spectral emissions, each of which individually complies with 47 C.F.R. § 15.245, 47 C.F.R. § 15.249, or [the UWB emission limits to be established in the UWB Report & Order].
- Option 2: 24 GHz ultra-wideband devices with residual carrier emissions need only comply with the absolute peak limit for the emission over its entire bandwidth, and need not comply with the peak signal strength limit measured over a 50 MHz bandwidth.
- Option 3: Ultra-wideband devices with composite waveforms that include both wideband and narrowband components that fall into the 24.0 – 24.25 GHz band need only comply with the absolute peak limit for the emission over the entire wideband bandwidth, and need not comply with the peak signal strength limit measured over a 50 MHz bandwidth.

The proposal contained in paragraph 58 of the NPRM does not stand as a bar to the clarifications requested above. In paragraph 58, the Commission

proposed to amend 47 C.F.R. § 15.215(c) to state that "intentional radiators operated under the provisions of 47 C.F.R. §§ 15.217-15.255 or Subpart E of the current regulations must be designed to ensure that the main lobe or necessary bandwidth, whichever is less, is contained within the frequency bands designated in those rule section[s] under which the equipment is operated." The purpose of the proposal was to prevent devices from operating at the higher power levels permitted under certain Part 15 rule sections when operating in UWB mode over a wide bandwidth outside the specific bands identified in Part 15 as suitable for higher powered use. It does not appear that the Commission's proposal was intended to restrict the use of hybrid or multimode devices that comply with discrete Part 15 rule sections (including UWB rule sections) relating to particular modes, or devices that produce composite waveforms that include both wideband and narrowband components.

If the Commission were to grant the proposals delineated in pages 12-14 of the attached presentation and issue the clarifications described above, it would make a significant contribution to improving safety on America's highways. SARA greatly appreciates the willingness of OET staff to meet with SARA to discuss these important issues. Those participating in the meeting at the FCC were Bruce Franca, Acting Chief of OET; Julius Knapp, Deputy Chief of OET; John Reed, Senior Engineer in OET; Josef Schuermann of JSConsulting; Daniel Selke of Mercedes-Benz USA; Tim Frasier and Fred Sejalon of Robert Bosch; Martin Kunert of Siemens VDO Automotive; Nicholas Morenc of Delphi Automotive Systems; Paul Zoratti of Visteon; Jeff Schaefer of M/A-COM; Jeff Krauss, consultant to M/A-COM; and Ari Fitzgerald and David Martin of Hogan & Hartson L.L.P., counsel for SARA.

Respectfully submitted,



Ari Q. Fitzgerald
Counsel for SARA

Enclosure

cc (w/enc.): Mr. Bruce Franca
Mr. Julius Knapp
Mr. John Reed

24 GHz Short Range Radar
FCC OET visit Nov.13th, 2001



SARA PRESENTATION

24 GHz Short Range Radar for Automotive Applications

**before the
Office of Engineering and Technology**

November 13, 2001

*Audi, BMW, DaimlerChrysler, Fiat, Ford, Jaguar, Opel / GM, Porsche, PSA Peugeot Citroën, Renault, Saab, Seat,
Volkswagen, Volvo, A.D.C., Bosch, Delphi, InnoSent, Megamos, Siemens VDO, TRW, Tycoelectronics, Valeo, Visteon.*

24 GHz Short Range Radar

FCC OET visit Nov.13th, 2001



AGENDA

• Introduction	A. Fitzgerald	Hogan & Hartson	3min
• SARA Group	J. Schuermann	JSConsulting	2min
• Road Safety, Overview, Goals	D. Selke	DaimlerChrysler	5min
• Frequency Rationale 24GHz	J. Schuermann	JSConsulting	5min
• Proposed Rulings	A. Fitzgerald	Hogan & Hartson	3min
• System Description Pulse	F. Sejalon	On behalf of Bosch Tyco, Valeo	10min
• System Description FHSS	M. Kunert	Siemens VDO	10min
• System Description BPSK	N. Morenc	Delphi	10min
• Summary of Proposals	J. Schuermann	JSConsulting	3min
• Discussion, Conclusion	All		15min

24 GHz Short Range Radar

FCC OET visit Nov.13th, 2001



SARA GROUP

- **ACRONYM:** Short Range Automotive Radar Frequency Allocation

- **CHARTER:**
 - Coordinate Regulatory Requirements for SARA Members
 - Agree on a Common Set of Spectrum Parameters
 - Create Radio Standards to enable Certification
 - Perform or contribute to Compatibility Studies
 - Worldwide harmonization

- **MEMBERS:**
 - Major Car Manufacturers (*Passenger and Truck*)
- **& Liaisons**
 - Leading Radio Frequency System, Component Manufacturers
 - Organizations such as ACEA, CLEPA, VDA
 - (*European & Global Auto and Auto Component Mfrs*)

Audi, BMW, DaimlerChrysler, Fiat, Ford, Jaguar, Opel / GM, Porsche, PSA Peugeot Citroën, Renault, Saab, Seat, Volkswagen, Volvo, A.D.C., Bosch, Delphi, InnoSent, Megamos, Siemens VDO, TRW, Tycoelectronics, Valeo, Visteon.

24 GHz Short Range Radar FCC OET visit Nov.13th, 2001



SARA Active Members

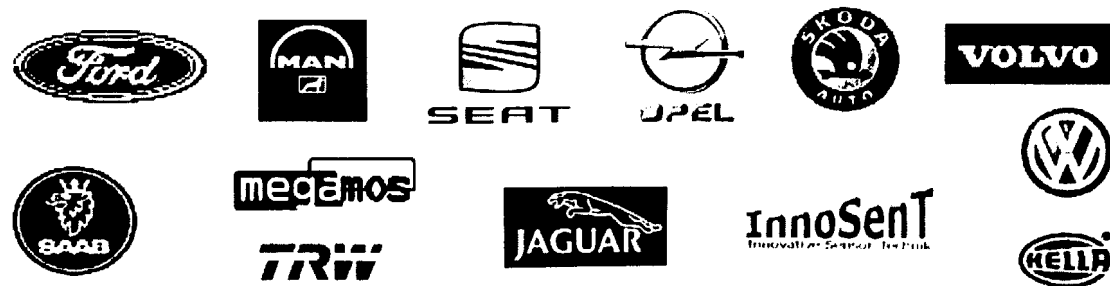
"EAG"
External Affairs Group



SARA Active Members "EG" -- *Expert Group*



SARA Supporting Members



Audi, BMW, DaimlerChrysler, Fiat, Ford, Jaguar, Opel / GM, Porsche, PSA Peugeot Citroën, Renault, Saab, Seat, Volkswagen, Volvo, A.D.C., Bosch, Delphi, InnoSent, Megamos, Siemens VDO, TRW, Tycoelectronics, Valeo, Visteon.

24 GHz Short Range Radar
FCC OET visit Nov.13th, 2001



Traffic scenarios

Need for accident prevention

**Accidents and pile-ups
on freeways**

**Rear-end collisions
in dense city traffic**

Parking lot collisions



“A death from vehicle crashes every 13 min. (injury every 14 sec.)
41,200 motor vehicle deaths per year.”
(National Safety Council, *Injury Facts*, 1999)

Statement of U.S.A. National Transportation Safety Board Public Meeting - 1 May 2001:

**“Develop and implement a program to inform the public
on the benefits, use, and effectiveness of C.W.S. and A.C.C.”**

(C.W.S. = collision warning system; A.C.C. = adaptive cruise control)

DAIMLERCHRYSLER

24 GHz Short Range Radar FCC OET visit Nov.13th, 2001

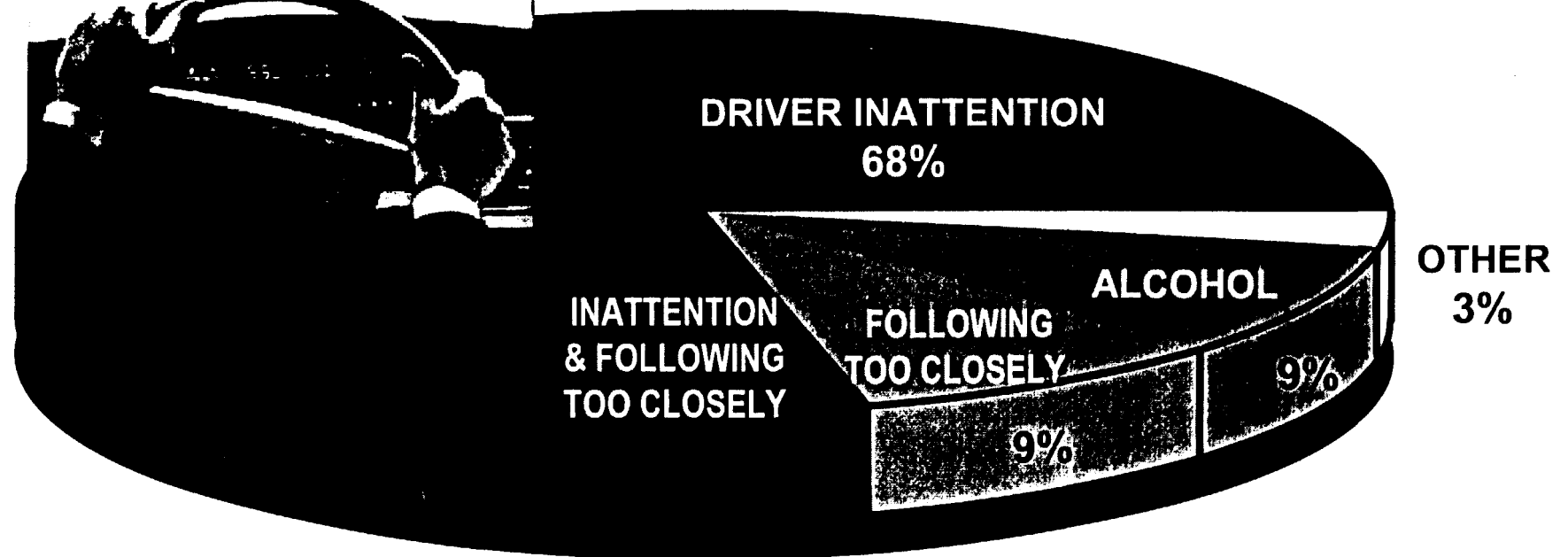
SARA 

DELPHI

Automotive Systems



Causes of Rear-End Crashes



Source: NHTSA

Audi, BMW, DaimlerChrysler, Fiat, Ford, Jaguar, Opel / GM, Porsche, PSA Peugeot Citroën, Renault, Saab, Seat, Volkswagen, Volvo, A.D.C., Bosch, Delphi, InnoSent, Megamos, Siemens VDO, TRW, Tyco Electronics, Valeo, Visteon.

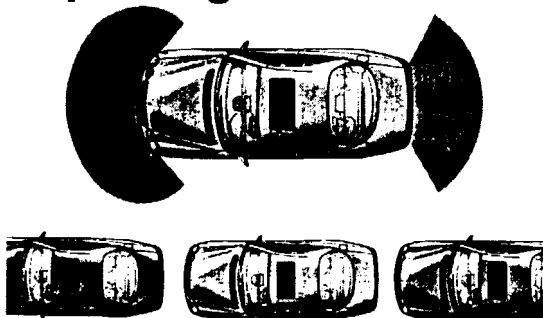
DAIMLERCHRYSLER

24 GHz Short Range Radar FCC OET visit Nov.13th, 2001

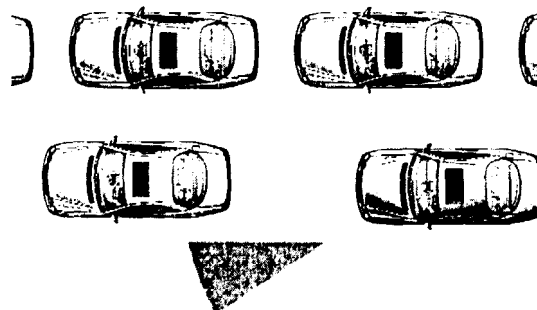
SARA 

Fields of application

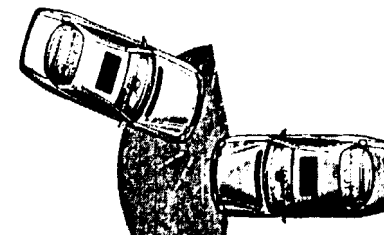
- parking situations



- dense city traffic



- PreSafe™



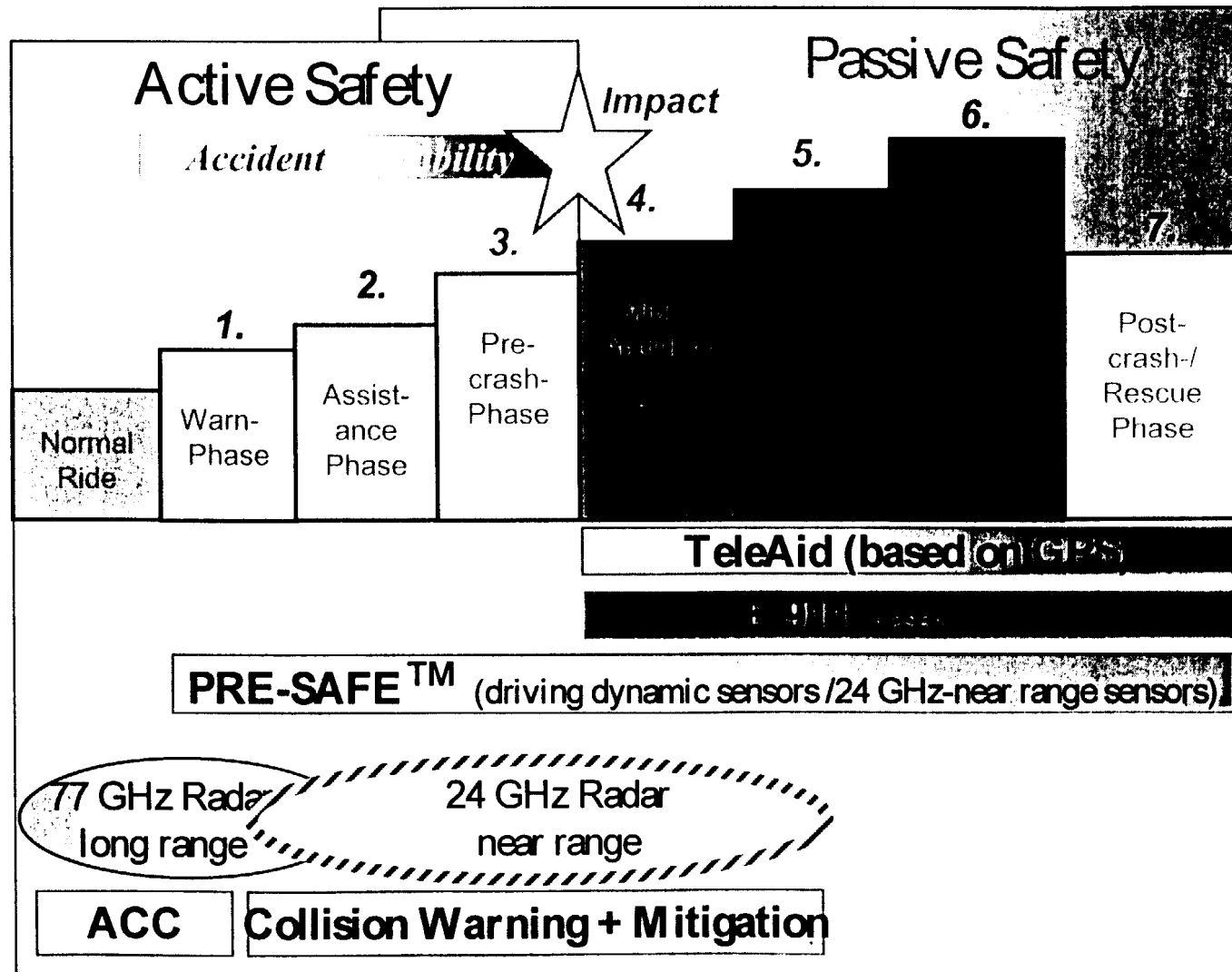
Audi, BMW, DaimlerChrysler, Fiat, Ford, Jaguar, Opel / GM, Porsche, PSA Peugeot Citroën, Renault, Saab, Seat, Volkswagen, Volvo, A.D.C., Bosch, Delphi, InnoSent, Megamos, Siemens VDO, TRW, Tyco Electronics, Valeo, Visteon.

24 GHz Short Range Radar FCC OET visit Nov.13th, 2001



Accident
scenarios

Active Safety
enabled by
Radar Sensors

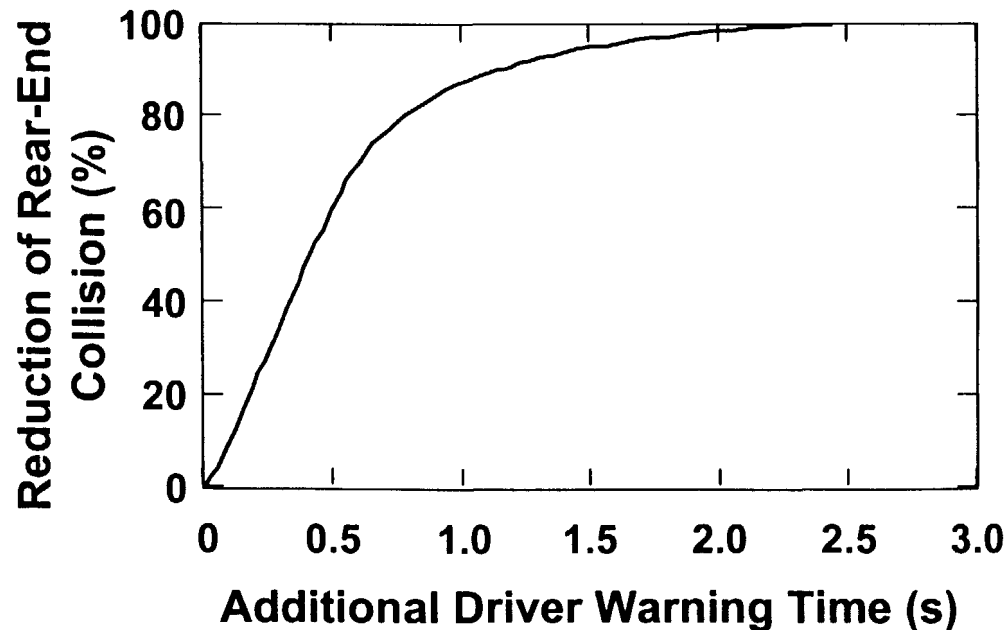


24 GHz Short Range Radar

FCC OET visit Nov.13th, 2001



- **“Roughly 37 to 74% of rear-end crashes are theoretically preventable by the use of headway detection systems”**
 - Source: R. Knippling, et al.; *Assessment of IVHS Countermeasures for Collision Avoidance: Rear End Crashes*, U.S. Dept of Transportation (NHTSA Technical Report HS807-995), Springfield, VA, 1993.
- **“Providing a driver with an additional 1-second of warning time to react can reduce rear-end collisions by nearly 90%”**
 - Source: Cited Daimler-Benz investigation, as reported by: Bill Siruru, “Do Collision Warning Systems Reduce Accidents”, UTS, Sept/Oct 1998.



DELPHI
Automotive Systems

Audi, BMW, DaimlerChrysler, Fiat, Ford, Jaguar, Opel / GM, Porsche, PSA Peugeot Citroën, Renault, Saab, Seat, Volkswagen, Volvo, A.D.C., Bosch, Delphi, InnoSent, Megamos, Siemens VDO, TRW, Tyco Electronics, Valeo, Visteon.

24 GHz Short Range Radar FCC OET visit Nov.13th, 2001



Potential benefits
... for public
traffic safety

- sensing of the vehicle's surroundings can provide the driver with a "virtual eye"
- semi-autonomous vehicle control may shorten braking distances
- additional time for preparation of safety systems (PreSafeTM)



- ➔ lower probability of crashes caused by cars with sensors
- ➔ enhanced mitigation of collision effects
- ➔ GPS necessary for E-911, no interference by 24 GHz radar expected
 - This radar system reacts 0.5 seconds faster than a human driver thus allowing 10 meters more braking distance in city traffic
 - ➔ 60% of rear-end collisions could be avoided
(Source: Daimler-Benz study, 1992)

Advantages of 24 GHz

- Integration of moderate antenna sizes into vehicle bumpers because of acceptable attenuation through bumper material
- Permits large BW required for high resolution
- Higher power allowed in 24.0 - 24.25 GHz (Sections 15.245 & 15.249)
- Propagation losses and antenna directivity minimize risk of interference
- Economical MIC design on low cost printed circuit boards
- Affordable
 - Availability of off-the-shelf components from multiple sources
 - High volume chip production
 - Mature automated production processes.
 - Significantly lower sensor cost than 77 GHz (multiple sensors required per system)

Disadvantages of 5.8 GHz and 77 GHz

- **5.8 GHz**
 - Integration of large antenna sizes into vehicle bumpers not feasible
 - 5.0 GHz bandwidth (-20 dB) required for high resolution impractical

- **77 GHz**
 - Unacceptable attenuation through bumper material
(Silver paint = 29 dB loss versus 6 dB at 24 GHz)

 - Existing band allocation too narrow to accommodate needed bandwidth

 - Cost Prohibitive
 - Low cost packaged components not available
 - Automated assembly processes not mature
 - Assembly tolerances will always result in tighter process tolerances

SARA's Requested Report & Order Decisions

In order to move forward with the development of their 24 GHz automotive radars, the members of SARA respectfully request the FCC to approve:

- Unlicensed operation of all 24 GHz automotive radars (FCC licensing would be cost prohibitive and is unnecessary).
- Operation of all 24 GHz automotive radars in the restricted bands covered under section 15.205 of the FCC's rules (including 23.6-24.0 GHz).
- Elimination of the pulse desensitization correction factor.
- An average emissions limit in UWB or equivalent mode of 500 microvolts/meter as measured at a distance of 3 meters (-41dBm).

24 GHz Short Range Radar
FCC OET visit Nov.13th, 2001



Decisions Requested in UWB Report & Order

(continued)

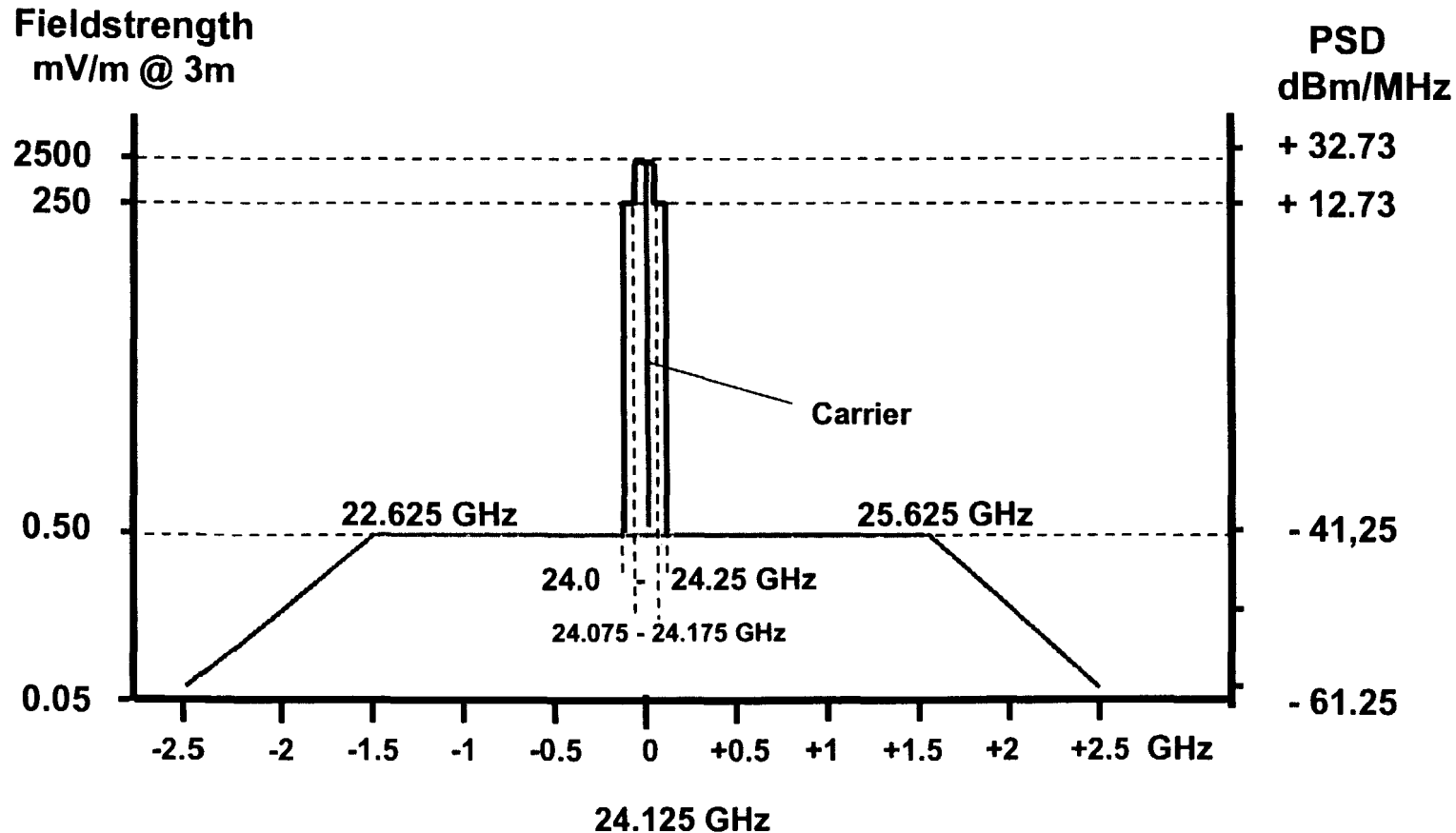
- Operation of a hybrid device under:
 - A) the emission mask proposed by SARA, or
 - B) as a combination of the FCC's UWB emission limits and sections 15.245 and 15.249 of the FCC's rules.
- The use of alternate modulation systems, including non-pulsed waveforms, at 24 GHz under the same rules.
- An increase from 20dB to 30dB in the NPRM's proposed limit for UWB mode or equivalent peak to average ratio.
- A minimum bandwidth of 500 MHz, instead of 1.5 GHz.
- Release of a FCC Report & Order resolving all these issues by December 2001.

24 GHz Short Range Radar

FCC OET visit Nov.13th, 2001

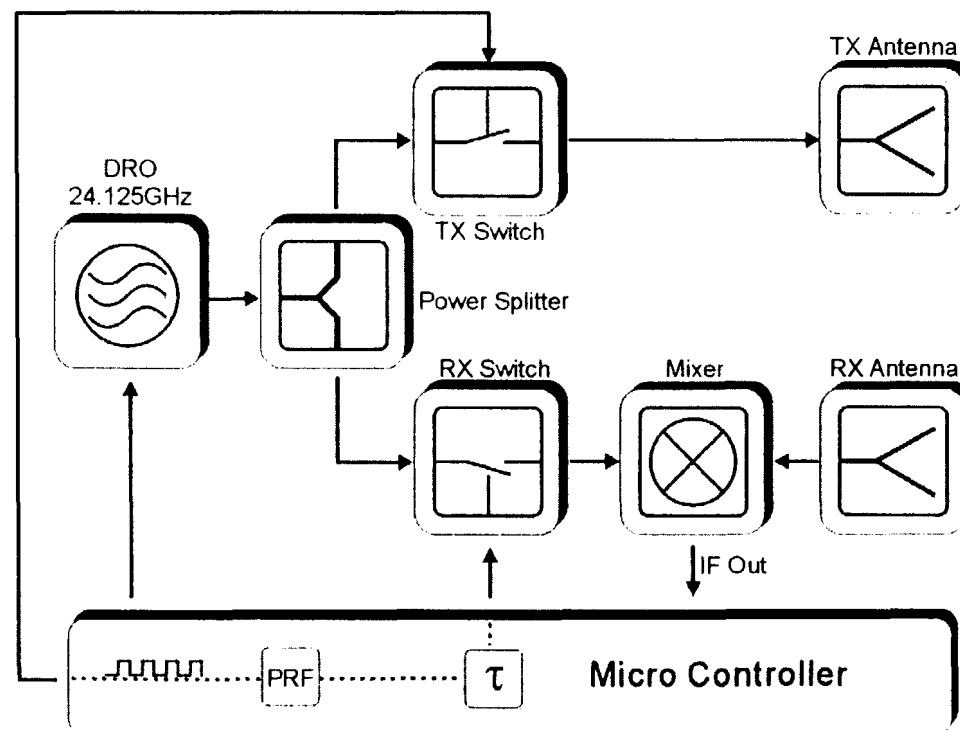


PROPOSED SARA TRANSMITTER MASK



Audi, BMW, DaimlerChrysler, Fiat, Ford, Jaguar, Opel / GM, Porsche, PSA Peugeot Citroën, Renault, Saab, Seat, Volkswagen, Volvo, A.D.C., Bosch, Delphi, InnoSent, Megamos, Siemens VDO, TRW, Tyco Electronics, Valeo, Visteon.

Pulsed Radar System Block Diagram



- Pulse Doppler Radar with amplitude modulation on 24 GHz carrier
- “Time of flight” measurement based on “equivalent time sampling” principle
- High receiver processing gain (Pulse Correlation & Integration), to allow ultra low power emissions
- Smoothed spectral power distribution due to pseudo-randomized pulse repetition

Pulsed System RF Characteristics

PARAMETER	SYMB	MIN	TYP	MAX		UNIT	NOTE
Carrier Frequency	f_{OP}	24.075	24.125	24.175		GHz	
Residual Carrier		Complies with Proposed SARA Mask				dBm	Due to finite switch isolation

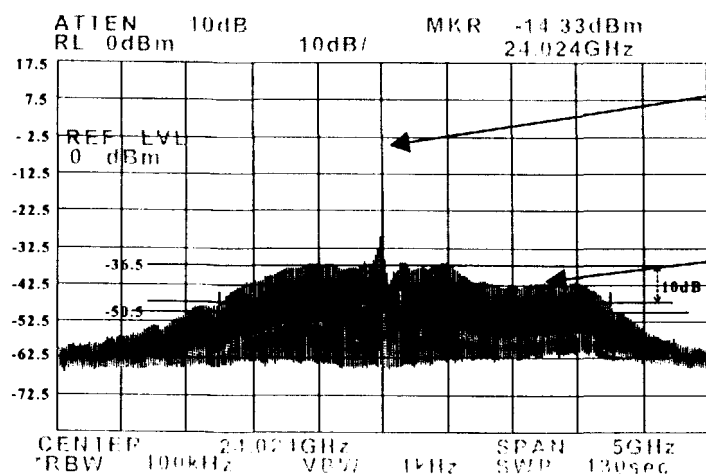
Possible Scenarios		Scenario 1	Scenario 2	Scenario 3	Scenario 4		
Peak power EIRP	P_{PK}	14.5	17.5	17.5	18.5	dBm	
Avg. power EIRP	P_{AVG}	-14.5	-9.95	-8.5	-8	dBm	Duty cycle dependent
Power Spectral Density Mean	PSD_{mean}	-107.5	-103.4	-101.5	-101.5	dBm/Hz	Below limit of: -101.25dBm/Hz
Power Spectral Density Peak	PSD_{peak}	-81.5	-81.4	-81.5	-81.5	dBm/Hz	Below limit of: -81.25dBm/Hz @ 50MHz
Pulse Width	t_{pulse}	500	450	500	450	ps	Gaussian pulse shape
Duty Factor	k_{duty}	29	27.45	26	26.5	dB	
Pulse Repetition Frequency	f_{PRF}	2.5	4	5	5	MHz	
Peak factor in 50MHz		26	22	20	20	dB	
Band Width @ -10dB		2.42	2.68	2.42	2.68	GHz	Gaussian pulse shape, > 1.5GHz provided

Antenna Characteristics		MIN	TYP	MAX		
Vertical Beamwidth	φ_{3dB}	12	15	18	deg	-3 dB points
Vertical Beamwidth	φ_{10dB}		26		deg	-10 dB points
Vertical Beam Offset	$\Delta\varphi$		0		deg	
Horizontal Beamwidth	ϑ_{3dB}	60	70	85	deg	-3 dB points
Horizontal Beamwidth	ϑ_{10dB}		105		deg	-10 dB points
Horizontal Beam Offset	$\Delta\vartheta$		0		deg	
Relative. Sidelobe Suppression	P_{SS}	18	22	26	dB	
Polarization						Linear

Pulse System Performance

PARAMETER	SYMB	MIN	TYP	MAX	UNIT	NOTE
Minimum Range		0.1	0.15	0.2	m	Pulse length dependent
Maximum Range			20		m	Pulse length and target (1m ² RCS) dependent
Precision / Accuracy		2	3.5	5	cm	
Target Separation		15	20	25	cm	Pulse length dependent
Mounting Height		20	50	150	cm	
Gating	t_{gate}	5	10	15	ms	TX Off time during calculation (max -3dB effect on average emissions)
Sweep Time	t_{sweep}	10	20	30	ms	Range sweep time
Cycle Time	t_{cycle}	15	30	45	ms	

Spectrum of Pulsed Systems

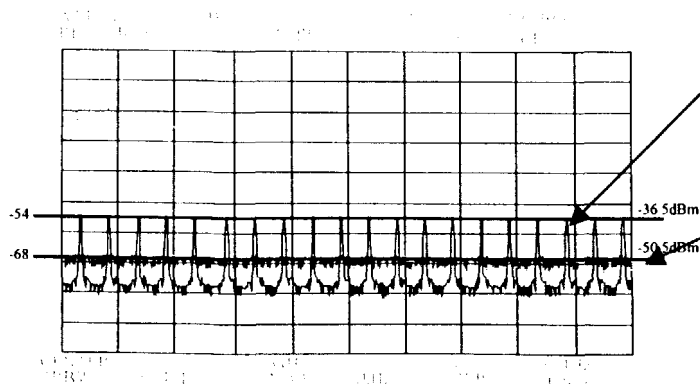


Residual carrier due to limited AM index

Absolute Bandwidth 3GHz @ -10dB
fractional BW app. 12.5%

Comb lines of unsmoothed spectrum

Power density of smoothed spectrum
(appr. -102dBm/Hz)
Emissions drop below thermal noise
($kT = -174\text{dBm/Hz}$) at distance of 4m
for isotropic receivers

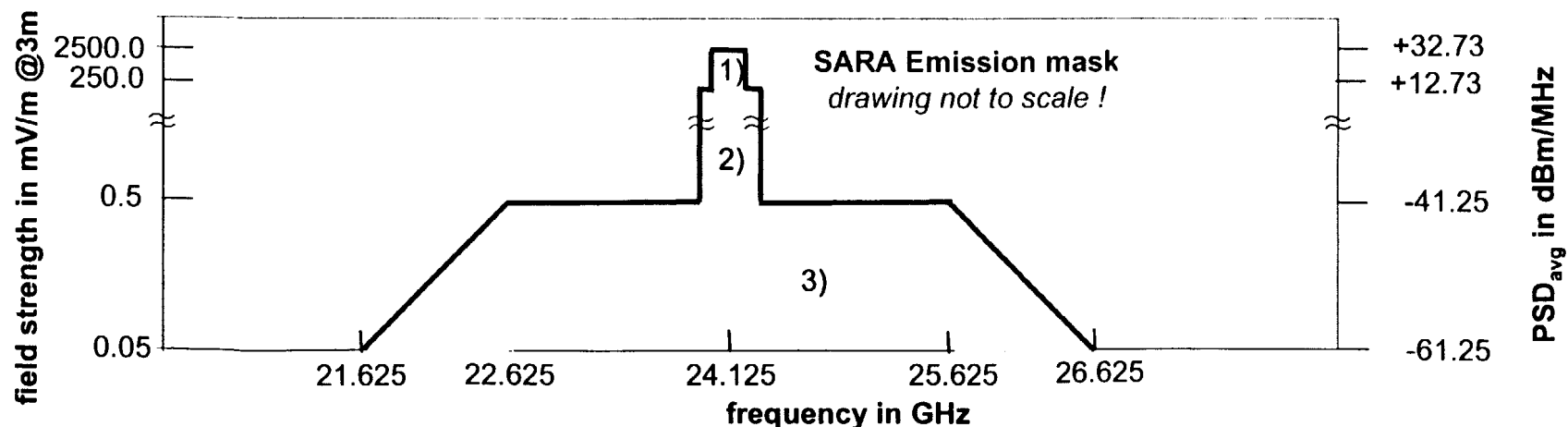


Proposed Rules for Ultra-Wideband

- The SARA Group proposes the inclusion of the following requirements for Pulse Systems:
 - Acceptance of proposed SARA transmitter mask
 - Increase of peak to average ratio from 20 dB to 30 dB within 50 MHz
 - Relaxation to 30 dB is requested by SARA to achieve full system functionality which is required for safety applications.
 - Consider increase of emission levels with higher frequencies because of higher propagation loss (24 GHz vs. 2.4 GHz ==> +20 dB).
To be addressed in ET Docket No. 01-278

Siemens VDO Automotive basic operational modes:

- 1) Only motion detection operating in the Field Disturbance Sensor band pursuant to 47 CFR, § 15.245 within the specified limits
- 2) Low resolution, far range (up to 30m) distance and speed measurement pursuant to 47 CFR, § 15.249 within the specified limits
- 3) High resolution, near range (up to 4m) distance and speed measurement pursuant to 47 CFR, § 15.209 within general emission limits



Audi, BMW, DaimlerChrysler, Fiat, Ford, Jaguar, Opel / GM, Porsche, PSA Peugeot Citroën, Renault, Saab, Seat, Volkswagen, Volvo, A.D.C., Bosch, Delphi, InnoSent, Megamos, Siemens VDO, TRW, Tyco Electronics, Valeo, Visteon.

Slide 1

Methods for achieving high resolution radar:

- Very short pulse width (below 1 ns to achieve more than 1000 MHz BW)
Implementation method:
Pulsed systems operate by rapid switching of a fixed carrier or even without any carrier at all
- Shifting of the carrier frequency over a large frequency range:
Implementation method:
Frequency Hopping (FH) systems that operates by rapidly changing over a large frequency range by the time, which results, on average, in a broadband signal
- Combination of pulsed and frequency hopping system (=pulsed FH):
Implementation method:
Only intermittent frequency changes of the carrier, resulting in a kind of independent time and frequency multiplexing technique